FIRE HISTORY FOR THE BIG BELT MOUNTAINS

HELENA NATIONAL FOREST

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INTRODUCTION

A field investigation of the Big Belt Mountains was conducted during the summer of 1992. The objective on this study was to develop a generalized fire history for vegetation types in eastern Montana. The information will also provide site specific information for seven of the major drainages in the Big Belt range.

STUDY SITES

Seven sites were sampled in this analysis. Site 1 centered in the Grassy Mountain area; Site 2 covered the Black Butte-Sulphur Bar Creek area; Site 3 included the North Fork, East Fork and West Fork of Deep Creek; Site 4 included the head of Duck Creek, Gypsy Lake and Thompson Gulch area; Site 5 covered Blacktail and head of Benton Creek in Confederate Gulch; Site 6 was located at the head of Magpie Creek in the Culp Gulch area and Site 7 covered the area between Favorite Gulch and Soup and Beaver Creeks.

All of the observations were collected in low to mid elevation forest vegetation types. Information on the grassland communities was recognized as a major concern; however, a survey of the BLM holdings southwest of Townsend provided limited data. Fir scars located on the scattered juniper and ponderosa pine all were from more recent events. Ages of most of these trees also indicated they were established since settlement of the area. The structure could indicate the area was treeless before effective fire control and intensive grazing or the trees were all cut by the first settlers in the area. Additional studies will be necessary to fully understand the fire process within the grassland types.

METHODS

There were two primary sources of information that were studied during the field investigation: fire scars within the study area and age structure of the stands. A series of ECODATA plots were located on various aspects and elevations to sample the variety of vegetation conditions. A search of the area was made to locate fire scarred trees. Where possible a wedge was removed from the tree showing the fire scar sequence. In cases where it was not safe to remove a wedge because of rot, lean or severity of the scar, the tree was felled and a slice taken from the fire scar region. A chainsaw powered increment borer was used to collect cores from at least three trees in each age class on or adjacent to the ECODATA plot. All age cores and fire scar blocks were taken to the office, sanded and age counted under a binocular microscope. The actual date of a fire event is subject to some uncertainty. Fire scar count may be in error as a result of false or missing rings or rings masked by pitch or rot. Counts on dead trees or stumps are also dependent on identifying the year the tree died or was harvested. Aging a fire event from the origin of a stand has even more uncertainty. Not only must an estimate be made of the years taken to grow to the sampling height on the tree but also an estimate of the time delay after the fire until a new stand was established. For these reasons fire events based on fire scars may vary plus or minus two or three years while those based on stand age may vary 5 to 10 years. All

estimates of fire return intervals are calculated from 1930 and earlier. It is assumed that after 1930 fire control effectiveness impacted the fire return cycle.

RESULTS

During the period between 1660 and 1930 about 42 fires were recorded by fire scars or stand origin information. A fire return interval of about every 6.4 years is indicated. Before 1740 data is limited and if the information is used between this date and 1930 the frequency drops to every 5.4 years. Fires were frequent throughout the Big Belts however no records were noted where a fire covered the entire Mountain Range. While the size of the unit does not appear large enough to preclude this type of event the area's configuration may have had an effect. About 14 percent of the time evidence of a particular fire year was found in 4 of the 6 major drainages sampled. This occurred in 1897, 1865, 1856, 1790, and 1782. Prior to this date the information base becomes more limited and may reflect a lack of data rather than a lack of large fire years. This data would suggest a major fire in the big Belts every 23 years.

If the fires that affected 3 or more drainages are considered moderate or severe fire events then the fire return interval for a major event would be about every 10 years. This frequency is similar to that described by Gabriel (1976) for the Bob Marshall area.

It is interesting to note that the 1910 fire year does not show up in the record and the 1889 fire year had limited impact in the Big Belts.

Development began early in the Big Belts as a result of mining activity and there could have been an impact on the fire return intervals that could be attributed to this activity. The record was divided into 40 year intervals to test this concern. Seven fires occurred between 1780 and 1820, nine between 1820 and 1860 and 10 between 1860 and 1900. This difference does not seem significant. While the number of fires was similar the timing of the fire and location may have been altered. Fires set by miners may have replaced those set by Native Americans. Fires starting in the grasslands that swept into the forested area may have been replaced by ignitions on site. This study was not able to evaluate these concerns. The severity of the fires may have been reduced with the number of single drainage fires increasing during the 1860 to 1900 period as shown in Table 1. Data before 1740 is incomplete because of the limited sample.

Table 1 – NUMBER OF FIRES BY TIME PERIOD BY NUMBER OF DRAINAGES IMPACTED

TIME PERIOD	NUMBER OF DRAINAGES IMPACTED			
	1	2	3	4
1900-1940	2	2	1	0
1860-1899	3	3	2	2
1820-1859	1	2	4	2
1780-1819	1	1	3	2
1740-1779	4	1	0	0
1700-1739	4	0	0	0
1660-1699	1	0	2	0

Age structure was very complex and varied both within the major drainages as well as within each fire group. Of the areas sampled about 30 percent had a single age component representing a stand replacement fire sometime in the past. This structure would suggest that at least a portion of the fires that burned in 1860, 1850, 1813, 1798 and 1790 were stand replacement events. Another 30 percent of the stands were two aged, 25 percent had three ages and 15 percent had four or more age classes.

MAJOR DRAINAGES

GRASSY MOUNTAIN – This area was primarily on the east side of the range and was separated from the Black Butte area to determine if a difference could be determined by drainage position. DF/snowberry-pinegrass habitat type was most common vegetation type. The area was dominated by relatively young Douglas-fir. The record for the area was limited and started about 1797. The fire return interval was 14.8 years with the 1860 to 1900 period the most active which may be due to mining activity. The longest fire free period was 38 years.

BLACK BUTTE – The Black Butte area was dominated by a variety of Douglas-fir cover types including DF/snowberry-pinegrass, DF/kinnikinnick, DF/twinflower and DF/elk sedge. Stands were composed of mature Douglas-fir. This area had one of the older records dating to 1666. The fire interval averaged 12.6 years and if the 1740 to 1930 period is used the interval drops to 11 years. Fire years by time interval were almost the same between 1780 and 1900. The longest fire free period was 21 years.

NORTH FORK – DF/snowberry-snowberry and DF/ninebark-pinegrass were the major cover types sampled. Major tree species were Douglas-fir and lodgepole pine. This drainage had a fire record dating to 1726 and a moderate fire return interval averaging about 20 years. Because of the limited amount of information before 1790 the interval may be overestimated and be closer to 15 years. The 1820 to 1860 period had the most records however it was not considered significantly different from other periods. The longest fire free period was 64 years but this may have been because of limited observations and a more reasonable estimate would be 35 years.

THOMPSON GULCH – A mix of vegetation types were found in this area including DF/snowberry-pinegrass, DF/pinegrass-wheatgrass and AF/dwarf huckleberry. The warmer sites were dominated by Douglas-fir and the cooler area was stocked with lodgepole pine. This drainage had one of the oldest records dating to 1660. The fire return interval was 22.5 years. Using the period from 1740 to 1930 results in a 19 year interval. Fire frequency by time interval was the same between 1780 and 1900. The longest fire free period was 87 years but it may be distorted by limited information early in the record. A more reasonable estimate may be 41 years.

CONFEDERATE GULCH – Vegetation types found here represent some of the more mesic conditions in the study area. DF/twinflower-snowberry and DF/huckleberry-huckleberry were most common and covered with mature Douglas-fir. The drainage has a similar record to Thompson Gulch and had a fire return interval of 24 years. This interval drops to 19 years

if the period between 1740 and 1930 is considered. The time periods between 1780 and 1860 had the most fire starts. The longest fire free period was about 33 years.

MAGPIE CREEK – The site contained a mixture of habitat types including DF/ninebark-ninebark, DF/snowberry-pinegrass and DF/elk sedge. The major species was mature Douglas-fir. The fire record for the drainage starts about 1700 and indicated a fire return interval of 16.4 years. The 1740 to 1930 time period is slightly less averaging 15.8 years. Fire starts by time period are about the same between 1700 and 1940 which is unusual. The longest fire free period was 39 years.

FAVORITE-SOUP – This area represented the driest site evaluated and was covered with DF/rough fescue and PP/bluebunch wheatgrass. Ponderosa pine dominated the site and contained some of the younger stands found in the study. It had one of the shorter fire return intervals of 13.9 years or 11.2 years between 1740 and 1900. The longest fire free period was 67 year because of limited data and probably was closer to 21 years.

TABLE 2 – NUMBER OF FIRES BY TIME PERIOD BY MAJOR DRAINAGE

TIME PERIOD	BLACK BUTTE	GRASSY MTN.	NORTH FORK	THOMPSON GULCH	CONFED. GULCH	MAGPIE CREEK	FAVOR. - SOUP
1900-1940	0	1	2	0	1	2	2
1860-1899	5	4	2	4	2	3	4
1820-1859	4	2	4	3	4	3	6
1780-1819	5	2	2	3	4	2	3
1740-1779	3	-	0	0	0	2	2
1700-1739	2	-	1	0	0	2	1
1660-1699	2	-	-	2	1	-	1

FIRE GROUPS

The majority of sites sampled were in fire Group 6 with a few in Group 4. Fire Group 2, 5 and 7 were also encountered. The fire return period for the Group 6 types averaged about 20 years at the drainage level and about 24 years at the stand level. This compares to an east side average of 42 years (Fisher 1983). The longest fire free period at the stand level was about 139 years.

Fire Group 4 was also represented and had a drainage level fire return period of 23 years and a stand average of 31 years. Fire intervals from Fisher suggest this type should average between 5 to 20 years. The longest fire free period at the stand level was about 143 years which may be distorted by limited data.

Fire Group 2 had a limited number of observations and had a fire return interval of 13 years at the drainage level and between 19 and 40 years at the stand level. Fisher's study suggests an average of between 2 and 20 years.

Fire Group 5 and 7 had information on one stand each. The interval for Group 5 was about 30 years compared to 35 to 40 years in Fisher's study. Data for Group 7 indicated a fire

return of 30 to 35 years which is significantly greater than found in Fisher's study which indicated a return closer to 100 years.

CONCLUSIONS

1. While stand replacement fires were common they appeared to have been spotty and more limited in size then noted on the Crazy Mountains study.

2. Fires in the Douglas-fir stands were either underburns or stand replacement events with aspect and slope commonly the deciding factor.

3. Fire events in the lodgepole pine cover type generally indicate a stand replacement event although two aged stands were encountered.

4. Ponderosa pine stands were surprisingly simple in age structure.

5. Major fires which covered significant portions of the Big Belts occurred at about a 10 year interval.

6. The fire of 1897 was probably the last major fire.

7. While some fire free periods were found that exceeded 140 years, stands sampled rarely escaped fire for over 40 years.

8. Stand ages were commonly young compared to those found in the Crazy Mountains and Beaverhead Forest studies.

9. Fires may have begun in the valley grasslands and moved upslope into the forested communities however this cycle may have not been as important as found in the Crazy Mountains or Beaverhead Forest studies.

REFERENCES

Fisher, William C.; Clayton, B.D. 1983. Fire ecology of Montana Forest Habitat types east of the Continental Divide. USDA, Forest Service General Technical Report INT-141. Intermountain Forest and Range Experiment Station, Ogden, UT 83p.

Gabriel, H.W., III, 1976. Wilderness ecology: The Danaher creek drainage, Bob Marshall Wilderness, Montana. Missoula, MT: University of Montana; 244p.

Pfister, Robert D., Bernard L. Kovalchik, Stephen F. Arno, and Richard C. Presby 1977. Forest habitat types of Montana. USDA For. Serv. Gen. Tech. Rep. INT-34. Intermountain Forest & Range Experiment Station, Ogden, UT 174p.

APPENDIX A - BIG BELT MOUNTAINS – HELENA FOREST FIRE HISTORY

FIRE YEAR	BLACK BUTTE	GRASSY MTN.	NORTH FORK	THOMP. GULCH	CONFED. GULCH	MAGPIE CREEK	FAVOR. SOUP
1937			X		X		
1929							X
1915		X?				X	X
1906	X?		X				
1902		X					
1897	X	X			X?	B	B
1889				B		X	X
1886	XB						
1884				X			
1877	XB					B	B
1875	X			X?			
1871						B	
1869	XB						
1865		B		XB	B		XB
1861		B	X				
1858					XB		X?B
1856		X	XB	B			B
1850	X	XB	XB				B
1846	XB		XB			B	X
1844				X			
1842	X						XB
1832	XB	B			B	X?B	
1829				B	B	B	
1821			B		B		B
1813			B			B	B
1811	B	B			B		B
1798	X?B	B		B	X?B		
1794	XB						B
1790	B		X	B	XB		
1785					XB		
1782	XB			B		B	X
1774	X?					X	
1767	X						
1753						X	
1749							X
1745	X						
1733							X
1726	XB?						
1715						B	
1705	XB						
1695	B			B		B	
1666	B				B		B
1660				B			

APPENDIX B		BIG BELTS VEGETATION DATA											
PLOT #	LOCATION	HABITAT TYPE	ELV	ASP	AGE	DOM TRE	TREES /AC	BASAL AREA	DBH	HT	PLANT COVER		
											SHRUB	GRAM	FORB
500	S21,T7N,R5E Grassy Mtn East	DF/snowberry-pinegrass	6110	346	156	DF	110	120	22	95	40	60	40
501	S34,T7N,R5E Grassy Mtn East	DF/snowberry – pinegrass	6530	65	130	DF	50	100	16	64	20	20	0
502	S3,T6N,R4E Black Butte	DF/snowberry – pinegrass	5930	285	196	DF	530	230	12	61	50	10	10
503	S34,T7N,R4E Black Butte	DF/kinnikinnick	5520	253	153	DF	130	60	10	43	10	3	0
504	S12,T6N,R4E Black Butte	DF/twinflower - snowberry	5720	52	184	DF	140	120	18	91	80	10	20
505	S20,T6N,R5E Black Butte	DF/elk sedge	6450	229	188	DF	130	170	30	81	10	40	50
506	S36,T9N,R3E Thompson Gul.	DF/snowberry – pinegrass	6440	84	152	DF	90	150	21	81	60	20	10
507	S20,T9N,R4E Thompson Gul.	AF/dwarf huckleberry	7130	173	177	LP	250	80	10	60	40	40	3
508	S28,T9N,R4E Thompson Gul.	DF/pinegrass-bluebunch wheat	7350	172	196	DF	60	160	21	48	10	80	20
509	S9,T7N,R5E North Fork	DF/snowberry – snowberry	5640	88	181	DF	180	110	18	81	60	20	10
510	S13,T7N,R4E North Fork	DF/ninebark – pinegrass	5650	358	141	LP	410	190	10	71	60	20	10
511	S30,T12N,R2W Favorite-Soup	PP/bluebunch wheatgrass	4440	154	171	PP	180	60	14	55	0	10	0
512	S13,T12N,R2W Favorite-Soup	PP/bluebunch wheatgrass	4540	131	138	PP	80	60	12	52	0	70	0

PLOT #	LOCATION	HABITAT TYPE	ELV	ASP	AGE	DOM TRE	TREES /AC	BASAL AREA	DBH	HT	PLANT COVER		
											SHRUB	GRAM	FORB
513	S5,T12N,R1W Favorite-Soup	DF/rough fescue	4300	220	129	PP	110	100	14	86	0	20	0
514	S21,T10N,R4E Confederate	DF/twinflower-snowberry	5610	309	198	DF	270	170	14	80	60	20	10
515	S22,T10N,R4E Confederate	DF/twinflower – snowberry	6310	257	175	DF	130	110	13	62	50	10	30
516	S7,T10N,R3E Confederate	DF/huckleberry-huckleberry	6350	154	150	DF	130	90	16	51	70	40	10
517	S34,T12N,R1E Magpie	DF/ninebark-ninebark	5120	115	237	DF	140	60	17	85	70	3	3
518	S34,T12N,R1E Magpie	DF/snowberry – pinegrass	5410	187	159	DF	90	80	19	88	30	20	3
519	S3,T11N,R1E Magpie	DF/elk sedge	6640	163	178	DF	150	110	16	61	0	30	10